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(57) Abstract

Mixtures of trifluoroethanol and at least one of sulfolane, 3-methylsulfolane, ethylene-, diethylene-, triethylene- or tetratethylene glycol, tri- or tetraethylene glycol dimethylether, di- or tripropylene glycol, di- or tripropylene glycol dimethyl ether.

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FLUIDS FOR USE IN SORPTION REFRIGERATORS AND HEAT PUMPS

The present invention relates to absorption heat transfer machines for transferring heat against a temperature gradient, and to working fluids for use therein.

Machines which transfer heat against a temperature gradient i.e. from a relatively cold heat source to a heat sink at higher temperatures are well known. These machines may be described as refrigerating machines. Refrigerating machines working on the absorption principle are well known. In such absorption heat transfer machines a pair of working substances is used which may be described as a refrigerant and an absorbent. The heat transfer process takes place in a closed system. Heat is taken into the system from outside by evaporation of the refrigerant in an evaporator. The evaporated refrigerant then passes to an absorber in which the refrigerant is absorbed in an absorbent which is poor in refrigerant. Heat is produced by the absorption and is given up to an external coolant. The liquid absorbent, now rich in refrigerant, is passed to a second evaporator (the generator) where heat is supplied to drive out the refrigerant from the absorbent. The resulting solution poor in refrigerant is returned to the absorber. The refrigerant vapour is cooled and liquefied by heat exchange with an external coolant and then returned to the evaporator.

Refrigerating machines may be used either to withdraw heat from material which it is desired to cool in which case they may be termed as refrigerators. Alternatively they may be used to introduce heat into material which it is desired to heat eg the air inside a house.

Machines intended for heating may be the conventional heat pumps in which heat at a relatively high temperature provides the energy to transfer heat from a relatively low temperature heat source to a heat sink at an intermediate temperature. Alternatively heat may be supplied from a heat source at an intermediate temperature and transferred to a heat sink at a relatively high temperature by making use of the energy obtained by the transfer of some of the heat down a temperature gradient from the heat source at intermediate temperature to a second heat sink at a lower temperature. Such machines may be described as heat transformers.

Working fluid pairs (refrigerant and absorbent) for use in absorption refrigerating machines should in particular satisfy the following requirements:

(a) the difference in boiling temperature between the refrigerant and the mixture of refrigerant and adsorbent should be as great as possible,

(b) the mixture of refrigerant and absorbent should not be solid in the range of compositions and working temperatures used,

(c) the mixture of refrigerant and absorbent should be thermally stable,

(d) the expenditure of energy required for rectifying the mixture evaporated from the generator in order to separate the absorbent from the refrigerant should be low,

(e) the viscosity of the mixture of refrigerant and absorbent in the range of working temperatures and compositions should be low.

GB 2080821 discloses mixtures of trifluoroethanol as refrigerant and diethylene glycol monomethyl ether as an absorbent in absorption refrigeration systems.

The suitability of a refrigerant-absorbent pair cannot be determined from the properties of the individual components. In particular, it is not possible to predict the stability of the refrigerant-absorbent pair. Thus not all glycols or glycol ethers are suitable for use with triflu roethanol.

The present invention provides working fluid pairs which fulfil the above requirements.

The present invention relates to a mixture of substances suitable for use in an absorption heat transfer machine, which mixture comprises 2,2,2-trifluoroethanol and an absorbent characterised in that the absorbent is at least one of sulfolane, 3-methyl sulfolane, ethylene-,diethylene, -triethylene- or tetra-ethylene glycol, tri-ethylene glycol dimethyl ether, tetra-ethylene glycol dimethyl ether, di- or tripropylene glycol, di- or tripropylene glycol dimethyl ether.

According to a further aspect of the present invention there is provided a process for transferring heat against a temperature gradient using a refrigerant which is 2,2,2-trifluoroethanol and an absorbent characterised in that the absorbent is at least one of sulfolane, 3-methylsulfolane, ethylene-, diethylene-, triethylene- or tetraethylene glycol, tri- or tetra-ethylene glycol dimethyl ether, di- or tripropylene glycol, di- or tripropylene glycol dimethyl ether.

The composition of the working fluid will of course vary in different parts of the heat transfer process. However the absorbent preferably is 50-95% by weight of the total weight of working fluid (refrigerant plus absorbent) in the heat transfer process as a whole.

The mixture of refrigerant and absorbent introduced into the machine may contain various additives such as corrosion inhibitors, stabilisers and/or surface active agents. These will generally remain in the absorbent unless they are volatile.

The present invention will now be illustrated by reference to the following experiment.

Measurements were carried out on various absorbents and on mixtures of the absorbents containing 10% wt trifluoroethanol (TFE) and 90% wt absorbent. The stability of the mixtures was also determined by sealing samples into a glass ampoule and heating for 100 hours at 200°C. The samples were than examined by gas chromatography to test for the presence of decomposition products. None were found.

The results are given in the Table.

The suitability of the absorbents for use with trifluoroethanol in absorption heat transfer machines can be seen from the results.

Table

Absorbent		Mixture		
Name	BP°C	Viscosity cSt/20°C	BP °C	MP °C
Sulfolane	283	7.4	181	6.8
3-methyl sulfolane	276	7.8	173	-16.5
Ethylene glycol	198	16.3	163	<-11.5
Diethylene glycol	245	25.8	163	<-10
Triethylene glycol	278	33.7	177	-40
Triethylene glycol dimethyl ether	216	2.2	169	<-45
Dipropylene glycol	230	67.9	165	-40
Tetraethylene glycol	328	390	174	-23.4
Tetraethylene glycol dimethyl ether	275	3.6	186	<-30

BP determined at atmospheric pressure

BP of trifluorethanol = 73.6°C

Claims:

1. A mixture of substances suitable for use in an absorption heat transfer machine which mixture comprises 2,2,2-trifluoroethanol and that it also contains at least one of sulfolane, 3-methylsulfolane, ethylene-, diethylene-, or triethylene or tetra-ethylene glycol, triethylene or tetra-ethylene glycol dimethyl ether, di- or tripropylene glycol, di- or tripropylene glycol dimethyl ether.

2. An absorption process for transferring heat against a temperature gradient using a refrigerant which is 2,2,2-trifluoroethanol and an absorbent characterised in that the absorbent is at least one of sulfolane, 3-methylsulfolane, ethylene-, diethylene-, triethylene- or tetra ethylene glycol, triethylene or tetra ethylene glycol dimethylether, di- or tripropylene glycol, di- or tripropylene glycol dimethyl ether.

3. A mixture according to claim 1 which comprises 2,2,2-trifluoro-ethanol and at least one of sulfolane, 3-methylsulfolane, ethylene-, diethylene-, or triethylene glycol, triethylene glycol dimethyl ether, and dipropylene glycol.

4. A process according to claim 2 wherein the absorbent is at least one of sulfolane, 3-methylsulfolane, ethylene-, diethylene-, or triethylene glycol, triethylene glycol dimethyl ether, and dipropylene glycol.

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 83/00231

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[3]: C 09 K 5/04

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC[3]	C 09 K; F 25 B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	GB, A, 2080821 (SANYO) 10 February 1982 see claims 1,2,3,7,9,10; page 3, lines 9-18	1-4
Y	Patents Abstracts of Japan, vol. 5, no. 156 (C-74)(828) 6 October 1981 The Patent Office, Japanese Government (Tokyo, JP) JP, A, 56-88485, Sanyo	1-4
Y	EP, A, 0030127 (DAIKIN) 10 June 1981 see claims 1,4; page 6, lines 1-23	1-4
A	EP A, 0034268 (MASCHINENFABRIK AUGSBURG) 26 August 1981	
A	GB, A, 1357947 (HALOCARBON) 26 June 1974	

* Special categories of cited documents: [15]

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IV. CERTIFICATI N

Date of the Actual Completion of the International Search [1]	Date of Mailing of this International Search Report [2]
8th November 1983	29 NOV. 1983
International Searching Authority [1]	**Signature of Authorized Officer [20]**
EUROPEAN PATENT OFFICE	G.L.M. Kruydenberg

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/GB 83/00231 (SA 5788)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 23/11/83

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
GB-A- 2080821	10/02/82	WO-A-	8102301	20/08/81
		JP-A-	56113340	07/09/81
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